OPIC
OFFICE DE LA PROPRIÉTÉ INTELLECTUELLE DU CANADA

CIPO
CANADIAN INTELLECTUAL PROPERTY OFFICE

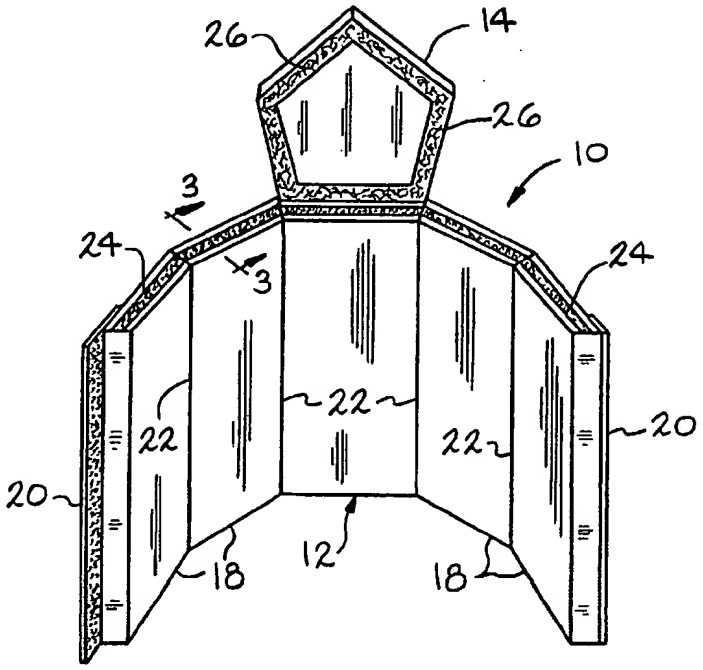
(12) (19) (CA) **Demande-Application**

(21) (A1) **2,214,302**
(22) 1997/08/29
(43) 1998/02/28

(72) BLANQUERA, Ben R., US
(72) LAISE, William J., Jr., US
(72) WEIR, Charles Russell., US
(71) OWENS CORNING, US

(51) Int.Cl.[6] G10K 11/16, E04B 1/84
(30) 1996/08/30 (08/706,149) US

(54) **MATELAS INSONORISANT**
(54) **ACOUSTICAL BLANKET**



(57) Matériau d'isolation multicouche comprenant au moins deux strates de deux couches, lesquelles sont composées d'une couche d'isolant fibreux et d'une couche de matériau coupe-son, qui réfléchit les sons. Au moins l'une des strates est pourvue de dispositifs de fixation, qui permettent de fixer le matériau d'isolation sur lui-même lorsqu'il a été plié autour d'un objet à insonoriser.

(57) A multilayered insulation product includes at least two two-part strata, each two-part stratum having a fibrous insulation layer and a sound reflecting barrier layer, and fasteners attached to at least one of the two-part stratums to enable the multilayered insulation product to be fastened together when folded around an article to be insulated.

ABSTRACT

A multilayered insulation product includes at least two two-part strata, each two-part stratum having a fibrous insulation layer and a sound reflecting barrier layer, and fasteners attached to at least one of the two-part stratums to enable the multilayered insulation product to be fastened together when folded around an article to be insulated.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS.

1. A multilayered insulation product comprising:

at least two two-part strata, each two-part stratum having a fibrous insulation layer and a sound reflecting barrier layer; and

fasteners attached to at least one of the two-part stratums to enable the multilayered insulation product to be fastened together when folded around an article to be insulated.

2. The product of claim 1 including a protective outer covering.

3. The product of claim 1 in which each two-part stratum comprises a layer of asphalt and a fiberglass insulation layer.

4. The product of claim 3 in which each fiberglass insulation layer has a density within the range of from about 0.5 pounds per cubic foot (8 kg/m^3) to about 10 pounds per cubic foot (160 kg/m^3), and the layer of asphalt has a thickness within the range of from about 1 mil to about 6 mils (about 0.025 mm to about 0.15 mm).

5. The product of claim 1 in which the fasteners are Velcro fasteners.

6. The product of claim 1 containing an aperture for allowing a protuberance to project through each of the two-part strata, and including a fastener for substantially closing the aperture.

7. The product of claim 1 comprising a first panel adapted to form a generally cylindrical shape when folded and a second panel adapted to form a lid for the first panel when folded into the generally cylindrical shape.

8. The product of claim 1 wherein the product is diaper-shaped.

9. The product of claim 1 wherein each two-part stratum is laminated to another two-part stratum, and wherein each two-part stratum comprises a layer of asphalt laminated to a fiberglass insulation layer.

10. The product of claim 9 including a protective outer covering, wherein each fiberglass insulation layer has a density within the range of from about 0.5 pounds per cubic foot (8 kg/m^3) to about 10 pounds per cubic foot (160 kg/m^3), and wherein each layer of asphalt has a thickness within the range of from about 1 mil to about 6 mils (about 0.025 mm to about 0.15 mm).

11. In combination, a noise producing machine and a multilayered insulation product, the multilayered insulation product comprising:

at least two two-part strata, each two-part stratum having a fibrous insulation layer and a sound reflecting barrier layer; and

fasteners attached to at least one of the two-part strata to enable the multilayered insulation product to be fastened together when folded around the noise producing machine.

12. The combination of claim 11 in which each two-part stratum comprises a layer of asphalt applied to a fiberglass insulation layer, and further includes a protective covering.

13. The combination of claim 11 in which the fasteners are Velcro fasteners.

14. The combination of claim 11 in which the multilayered insulation product has a first panel folded to form a generally cylindrical shape and a second panel forming a lid for the first panel.

15. The combination of claim 11 in which the noise producing machine is a compressor and in which each two-part stratum comprises a layer of asphalt applied to a fiberglass insulation.

16. The combination of claim 15 in which the fasteners are Velcro fasteners, and in which the multilayered insulation product has a first panel folded to form a generally cylindrical shape and a second panel forming a lid for the first panel.

17. The combination of claim 11 in which the noise producing machine contains a protuberance and in which the multilayered insulation product contains an aperture for allowing the protuberance to project through each of the two-part strata, and including a fastener for substantially closing the aperture around the protuberance.

18. The combination of claim 11, wherein the multilayered insulation product is diaper-shaped.

ACOUSTICAL BLANKET

TECHNICAL FIELD AND INDUSTRIAL APPLICABILITY

This invention relates in general to insulation products of fibrous materials. More specifically, this invention relates to a multilayered insulation product of the type suitable for providing acoustical protection from a source of unwanted noise. The invention will be useful as acoustical insulation for office panels, appliances, automotive applications, and heating, ventilating and air conditioning equipment.

BACKGROUND OF THE INVENTION

Insulation products are commonly used in various applications to prevent unwanted sound from escaping from a noise-producing device, such as a motor, machine or appliance. Acoustical insulation products are provided in various forms and of various materials. One form of acoustical insulation involves enclosing the noise source in an insulation structure. A typical form of acoustical insulation is a layer of mineral fiber insulation, such as fiberglass insulation, wrapped around or positioned around the source of unwanted noise. For example, a fiberglass blanket is usually incorporated in the front door panel of an under-the-counter dishwasher. It is known that the glass fibers absorb some of the sound energy entering the fiberglass board, thereby resulting in a reduced transmission of unwanted sound through the acoustical insulation. Further, it is known that the insertion of a reflecting sound barrier within the acoustical insulation also reduces the sound transmission through the insulation product. Reflecting sound barriers in the past have been made of paper and also of a thin layer of polymeric material, as well as of other materials.

Existing methods of manufacturing acoustical insulation products include making a multilayer insulation product by applying a reflecting barrier to a first or bottom insulation layer and then applying a second or top insulation layer. The reflecting barrier is typically a film such as a paper or foil, or a layer of polymeric material, and the reflecting barrier is typically adhered to the top and bottom insulation layers by an adhesive or by the polymeric layer. A recent development to reduce the cost of the acoustical insulation product includes using a layer of asphalt as the reflecting barrier, and in some cases for laminating the two fibrous insulation layers together. Asphalt is a thermoplastic material

that is quite inexpensive compared to most polymeric materials, and can be easily applied to the fibrous insulation.

Merely applying a layered insulation and sound barrier laminate to noise producing equipment has been found to provide unsatisfactory acoustical performance for many noise sources. The insulation material often has inadequate insulating capability for the level of sound energy under consideration. Further, applying the insulation product to the equipment can be time consuming. Also, once the insulation is installed, removal of the insulation for inspection or maintenance of the equipment can be burdensome, often resulting in destroyed insulation which must be replaced with new insulation.

It would therefore be desirable to have an acoustical insulation product that would be suitable for effectively insulating sound generating sources, and could be relatively easily installed and readily removable for inspection or maintenance of the equipment. Such an insulation product should be relatively easy to manufacture, and should be capable of being tailored to the particular equipment to be insulated.

SUMMARY OF THE INVENTION

The above object as well as other objects not specifically enumerated are achieved by a multilayered insulation product which is made of at least two two-part strata, with each two-part stratum having a fibrous insulation layer and a sound reflecting barrier layer. Fasteners are attached to at least one of the two-part strata to enable the multilayered insulation product to be fastened together when folded around an article to be insulated. The multilayered insulation product of the invention can also be provided in combination with a noise producing machine where the fasteners enable the multilayered insulation product to be fastened to itself when folded around the noise producing machine.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view in perspective of the multilayered insulation product of the invention.

Figure 2 is a schematic view in perspective of the multilayered insulation product of the invention in combination with a noise generating compressor.

Figure 3 is a schematic cross-sectional view in elevation of the multilayered product of the invention shown in Figure 1, taken along line 3-3.

Figure 4 is a schematic cross-sectional view in elevation of apparatus for making the multilayered insulation product of the invention.

Figure 5 is a schematic plan view of another embodiment of the multilayered insulation product of the invention.

Figure 6 is a schematic view in perspective of the insulation product of Figure 5, shown in a folded condition.

DETAILED DESCRIPTION AND PREFERRED EMBODIMENTS

Referring now to the drawings, Figure 1 illustrates the multilayered insulation product of the invention, indicated generally at 10. The multilayered insulation product includes main body panel 12 and lid panel 14. As shown in Figure 2, the multilayered insulation product 10 can be folded around a noise producing machine, such as a compressor 16, to provide a reduction in the noise emitted from the compressor. It can be seen that the insulation product comprises a first panel 12 adapted to form a generally cylindrical shape when folded and a second panel 14 adapted to form a lid for the first panel when folded into the generally cylindrical shape. Although the shape shown in Figure 1 is that of a pentagonally cylindrical main body panel 12 and a pentagonal lid panel 14, other shapes of the insulation product can also be useful with the invention. The form of the multilayered insulation product can be any form or shape suitable for being attached to or used with a noise producing machine for the purpose of reducing the sound emitted from the machine.

To facilitate attachment of the insulation product 10 to the compressor, the main body panel 12 is comprised of side panels 18, one of which includes a fastener, such as a pair of mated edge Velcro® strips 20, so that the insulation product 10 can be fastened to itself when installed on the compressor. As is well known to those in the art, Velcro fasteners include mating strips, one of which has many tiny loops and the other of which has many tiny hooks which attach to the loops. The side panels 18 can be formed merely by folding the insulation product along fold lines 22, or can be formed by making creases or hinges, not shown, in the body panel. Fasteners, such as body panel Velcro strips 24 and mating lid strips 26, can be placed wherever necessary to enable the insulation product 10 to be fastened together or to itself when folded around the article to be insulated. The term "fastened together" includes both fastening the insulation product to itself and fastening the insulation product to the article to be insulated. Although the fasteners shown are Velcro fasteners, numerous other types of fasteners can be used. For example, clips, hooks, sewing, buttons and zippers could also be used to fasten the insulation product 10 together

or to itself once installed on the article to be insulated. Fasteners that can be easily and quickly removed for maintenance and inspection of the article to be insulated, and then subsequently readily reinstalled, are preferred.

As shown in Figure 3, the multilayered insulation product 10 contains two two-layer strata 30. Also included is an optional exterior layer, such as vinyl layer 32, and an optional interior layer, such as interior vinyl layer 34. The exterior and interior layers can be of any material suitable for the application to protect the strata of the multilayered insulation product. For example, the exterior layer 32 should have high weatherability qualities, i.e., should be weatherproof, where the insulation product is going to be exposed to the outside elements.

Each of the strata 30 is a two-part structure comprised of a fibrous insulation layer, such as a fiberglass blanket 36, and a sound reflecting barrier layer, such as an asphalt layer 40. The insulation material can be any fibrous material suitable for absorbing sound energy. Besides glass fibers, such fibers as other mineral fibers and organic fibers can be used. In automotive sound insulation applications, for example, the preferred insulation fibers may be polyester fibers or polypropylene fibers. Typically, the insulation material has between about 5% and about 10% by weight of a phenolic resin binder such as phenol-urea-formaldehyde, to enhance the tensile strength of the fiberglass. Preferably the fiberglass insulating material has a relatively low density between about 0.5 pounds per cubic foot (8 kg/m^3) and about 10 pounds per cubic foot (160 kg/m^3), more preferably between about 0.5 pounds per cubic foot (8 kg/m^3) and about 2 pounds per cubic foot (32 kg/m^3), and most preferably between about 0.9 pounds per cubic foot (14.4 kg/m^3) and about 1.5 pounds per cubic foot (24 kg/m^3). The glass fibers in the insulating material preferably have an average diameter between about 3 and about 25 microns, and more preferably between about 3 and about 12 microns. The fiber diameter and density of the glass fiber blanket can be varied to modify the sound absorption characteristics of the insulation layer. A preferred fiberglass insulating material, HV-24, is commercially available from Owens Corning, Toledo, Ohio.

While the purpose of each fiberglass layer 36 is to absorb the sound energy, the purpose of each asphalt layer 40 is to reflect sound energy back into the glass fibers for absorption, and to prevent transmission of the sound energy through the insulation product. Typically the amount of asphalt present in each asphalt layer will be within the range of from about 0.1 to about 0.7 lb/ft^2 (about 0.49 to about 34 kg/m^2), and preferably at an

amount of about 0.3 lb/ft^2 (about 1.5 kg/m^2). Typically, the asphalt layer has a thickness within the range of from about 1 mil to about 6 mils (about 0.025 mm to about 0.15 mm). In one method of making the insulation product of the invention, the asphalt layer 40 is applied in a molten form to the fiberglass insulation layer 36 so that the asphalt material can penetrate at least some of the interstices between fibers. This will strongly bond or laminate the asphalt layer to the fiberglass layer. Other means for laminating the asphalt layer 40 to the fibrous insulation layer, such as an adhesive, can also be used. In another embodiment of the invention, the asphalt layer is added to or applied to the fiberglass layer in a solid, unmelted form.

Although the sound reflecting barrier is disclosed above as being asphalt, numerous other materials could also be applied to the insulation layer 36 to bond the multilayered insulation product together and to provide a solid barrier for sound transmission through the product. For example, the sound reflecting barrier could be a thermoplastic adhesive such as a hot melt polymeric material, an example of which is hot melt adhesive No. 50-823, from Reynolds Adhesive, Greenville, South Carolina. The sound reflecting barrier could also be a thermoset adhesive, such as an epoxy adhesive. Other examples include water-based latex adhesives, such as aqueous adhesive No. 20983 from Northwest Adhesives, Minneapolis, Minnesota.

The type of asphalt used in the asphalt layer 40 is not critical. The asphalt can be any bituminous material such as tars, pitches or asphalts. The asphalt can be any natural or petroleum derived asphalt. The common source of asphalt is the residue or bottoms from the petroleum refining industry which includes those commonly referred to as paving grade, roofer's flux, propane washed and air-blown.

The asphalt can optionally be modified with a polymer to give it improved flexibility during handling, and improved resistance to flow to prevent changes in thickness from top to bottom in the sound screen. A preferred polymer is a styrene/butadiene copolymer such as Kraton 1101 (20% styrene, 75% butadiene) from Shell Co., Houston, Texas. The weight ratio of asphalt to polymer is preferably between about 6:1 and about 20:1. The polymer can be mixed into the asphalt under high shear at 300°F (149°C) to 400°F (204°C).

Another preferred polymer is formed by copolymerization of SBS thermoplastic rubber and styrene monomer. Such a polymer is described in more detail in

U.S. Pat. No. 4,273,685 to Marzocchi et al., issued June 16, 1981, and U.S. Pat. No. 4,333,866 to Uffner, issued June 8, 1982.

Other polymers that may be useful as asphalt modifiers include ethylene copolymers such as Elvax® 450 (ethylene vinyl acetate copolymer) or Elvaloy® AM (ethylene butylacrylate glycidyl methacrylate terpolymer) both made by Du Pont (Wilmington, Delaware). Other polymers can include polybutadiene or polypropylene.

Various fillers can be incorporated into the asphalt layer 40 to increase the mass of the layer and thus reduce the amount of sound transmitted through the sound reflecting barrier. Preferably the filler is selected from calcium carbonate, calcium oxide, clay, glass, mica, barium, and mixtures thereof. More preferably the filler is calcium carbonate because it is inexpensive and contributes significant mass. Additives can also be incorporated into the asphalt layer 40 to provide it with additional properties such as fire retardancy. The type and amount of filler can affect the flexibility of the product. The filler and the asphalt combination should retain the quality of being relatively easy to cut so that the product can be easily fabricated.

As shown in Figure 3, the insulation product 10 can be provided with an aperture 42 to allow protuberances, such as refrigerant tubes 44, or electrical connections, not shown, to pass through the insulation product. In such an instance, a fastener or closure such as Velcro patch 46, can be used to seal or substantially close the aperture to the extent possible to maintain the highest possible acoustical insulation.

Figure 4 shows one method for making the multilayered insulation product of the invention. A first roll 50 of fibrous insulation material, supported or mounted in any suitable manner, such as by a cradle 52, is payed out as a first insulation layer 54. The first insulation layer is transported past the asphalt applicator station, indicated generally at 56, by applicator conveyor 58. Any means for moving the first insulation layer can be used. Typical line speeds for the applicator conveyor can be about 50 ft/sec (about 15 m/sec).

A roll 60 of a retention layer or veil 62, such as a spun bonded polyester fiber retention veil, is mounted to deliver the veil 62 into contact with the first insulation layer 54. The purpose of the retention veil is to hold down the upper strata or fibers in the first insulation layer as it passes the applicator station 56, thereby preventing the first insulation layer from delaminating. The applicator station is comprised of a coating roller or applicator roll 66 and coater gap roller 68 which together form a gap through which a

thin layer 70 of viscous, hardenable liquid, such as asphalt, passes. The liquid can be supplied in molten form as a stream 72 from a source, not shown, and can be accumulated as a pool 74 of molten liquid above the gap. The applicator roll can be heated to maintain the liquid at the correct temperature for operation of the process. The application temperature of asphalt is preferably within the range of from about 200°F to about 475°F (about 93°C to 246°C). A lift roller 76, or any other suitable means, can be used to cause an increase in the angle of wrap of the retention veil and the first insulation layer so that complete contact is made with the applicator roll 66. As shown, the lift roller can be mounted for movement to change the angle of wrap and the compression of the insulation. The liquid layer 70 laminates itself to the first insulation layer 54 to form a two-part stratum.

A second roll 80 of fibrous insulation material, supported or mounted in any suitable manner, such as by a cradle 82, is payed out as a second insulation layer 84. The second insulation layer 84 is applied to the tacky layer 70, and is transported past a second applicator station, indicated generally at 86, by applicator conveyor 88. A second roll 90 of a retention layer or veil 92 is mounted to deliver the veil 92 into contact with the second insulation layer 84 to hold down the upper strata or fibers in the second insulation layer as it passes the applicator station 86, thereby preventing the second insulation layer from delaminating. The second applicator station is comprised of a second applicator roll 96 and coater gap roller 98 which together form a gap through which a thin layer 100 of viscous, hardenable liquid, such as asphalt, passes. The liquid can be supplied in molten form as a stream 102 from a source, not shown, and can be accumulated as a pool 104 of molten liquid above the gap. The applicator roll can be heated to maintain the liquid at the correct temperature for operation of the process. A second lift roller 106 can be used to cause an increase in the angle of wrap of the retention veil so that complete contact is made with the applicator roll 96.

The retention veil 62 or 92 can be any film or web suitable for holding down the upper strata of an insulation layer. It can be woven or nonwoven. Preferably the veil has a tensile strength greater than about 3 lbs/inch width (greater than about 0.54 kg/cm width). The retention veil must be porous or perforated, preferably having a Frasier air permeability within the range of from about 300 to about 1500 cubic feet/minute per $Ft.^2$ (about 5,490 to about 27,450 m^3/hr per m^2), and most preferably a Frasier air permeability

within the range of from about 800 to about 1000 cubic feet/minute per $Ft.^2$ (about 14,640 to about 18,300 m^3/hr per m^2). The retention veil is preferably a spunbonded polyester porous web, having a weight within the range of from about 0.75 to about 1.0 oz. per $yd.^2$ (about 25 to about 34 g/m^2). Preferred retention veils are Remay spunbonded polyester veils Nos. 2011 and 2014 from Remay, Inc., Old Hickory, Tennessee. The retention veil must have a service temperature higher than the temperature of the molten liquid. If, for example, asphalt is to be applied at a temperature of about 400°F (204°C), then the retention veil should have a service temperature of at least 450°F (232°C). A polypropylene porous veil could be used, but since polypropylene has a relatively low service temperature, a relatively cool asphalt would have to be used in that case. The retention veil 62 or 92 can be a polyester film that has been perforated to render it porous to liquid, hardenable asphalt, and yet is capable of holding down a fiberglass insulation layer and preventing it from delaminating during the asphalt application process. During application of the liquid the retention layers 62, 92 compress the insulation layers 54, 84, thereby making the application process easier and assuring complete contact between the layers 70, 100 and the insulation layers. Typically, during the application of asphalt, the insulation layers are compressed to a thickness within the range of from about 0.5 to about 0.1 times the uncompressed thickness of the insulation layer.

A benefit in having a retention veil embedded in, e.g., an asphalt layer, is that it can increase the tensile strength of the asphalt layer after the asphalt has solidified. This could be particularly advantageous during cold weather exposure when the asphalt layer becomes brittle and is susceptible to cracking. The presence of the veil also will increase the flexural strength and reduce the modulus of rigidity. The modulus of rigidity can be increased by using a glass fiber mat as the retention veil.

It is to be understood that, if asphalt is used, it does not necessarily have to be added in liquid form with an applicator roll as shown in Figure 4, but can be applied as an extruded asphalt layer from an extruder. Alternatively, the asphalt can be applied as an asphalt layer formed into a thin film or sheet by a calender roll. While neither of these processes are shown herein, they are shown and described in more detail in a copending related application U.S. Serial No. 08/706,106, entitled METHOD OF MAKING A MULTILAYER INSULATION PRODUCT, filed on 30 August 1996, a copy of which is attached hereto.

Once the second layer 100 has been applied, the exterior and interior coverings or layers 32, 34 can be added by any suitable process, not shown. The entire laminate can then be cut and fabricated to form the multilayered insulation product of the desired shape. Fasteners then can be added and the multilayered insulation product is ready for application to a noise producing machine.

Although each two-part stratum contains a fibrous insulation layer 36 and a sound reflecting barrier layer 40 applied to the fibrous layer, one or more additional fibrous insulation layers can be added to any of the strata. Also, although only two of the two-part strata 30 are shown, any number of two-part strata can be incorporated into the multilayered insulation product 10 of the invention.

In general, it has been found that increasing the mass of the sound reflecting barriers increases the acoustical insulation ability of the product. Therefore, the product can be tailored somewhat to fit the acoustical characteristics of the noise source. Higher mass in the sound reflecting barriers and a greater fiberglass density are required to handle low frequency unwanted sound. Also, higher frequency sound requires a greater thickness between the asphalt sound reflecting barriers, i.e., a greater thickness of the fiberglass insulation. With the ability to incorporate the desired acoustical properties into the product, the product can be designed to be particularly effective against the most offensive frequencies in a particular application.

As shown in Figures 5 and 6, the multilayered insulation product of the invention can be fabricated for easy folding by cutting the product into a shape similar to the shape of a diaper. The product, indicated at 110, is comprised of two side panels 112, a top panel 114 and end panels 116. Mated end Velcro strips 120, 122 are bonded to each of the end panels. After the multilayered product is folded into the shape shown in Figure 6, the end Velcro strip 120 is attached to the mated Velcro strip 122 along seam 124 to conform the multilayered insulation panel to the shape of the article to be insulated. This design allows fast installation and easy removal for inspection or maintenance of the article being insulated. It is to be understood that although the fastener is shown as being mated Velcro strips, any other suitable fastener can be used.

The principle and mode of operation of this invention have been described in its preferred embodiment. However, it should be noted that this invention may be practiced otherwise than as specifically illustrated and described without departing from its scope.

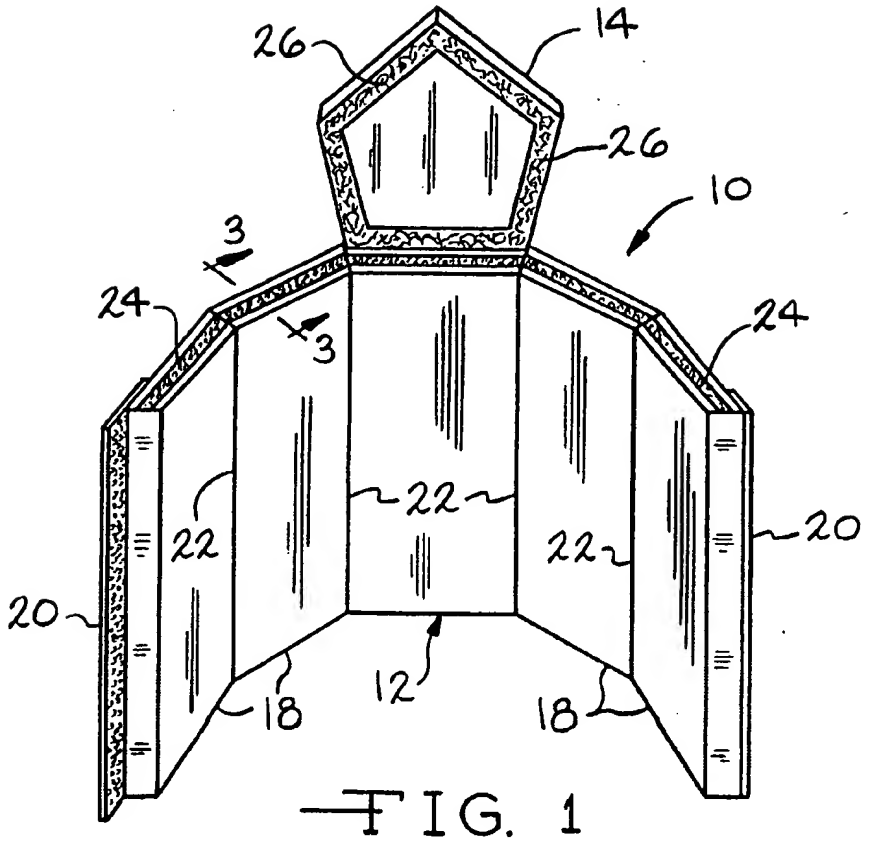


FIG. 1

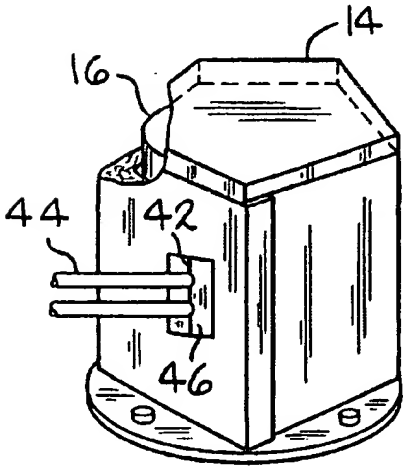


FIG. 2

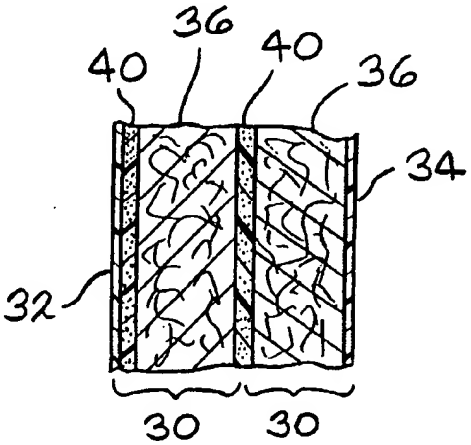


FIG. 3

Patent Agents
Smart & Biggar

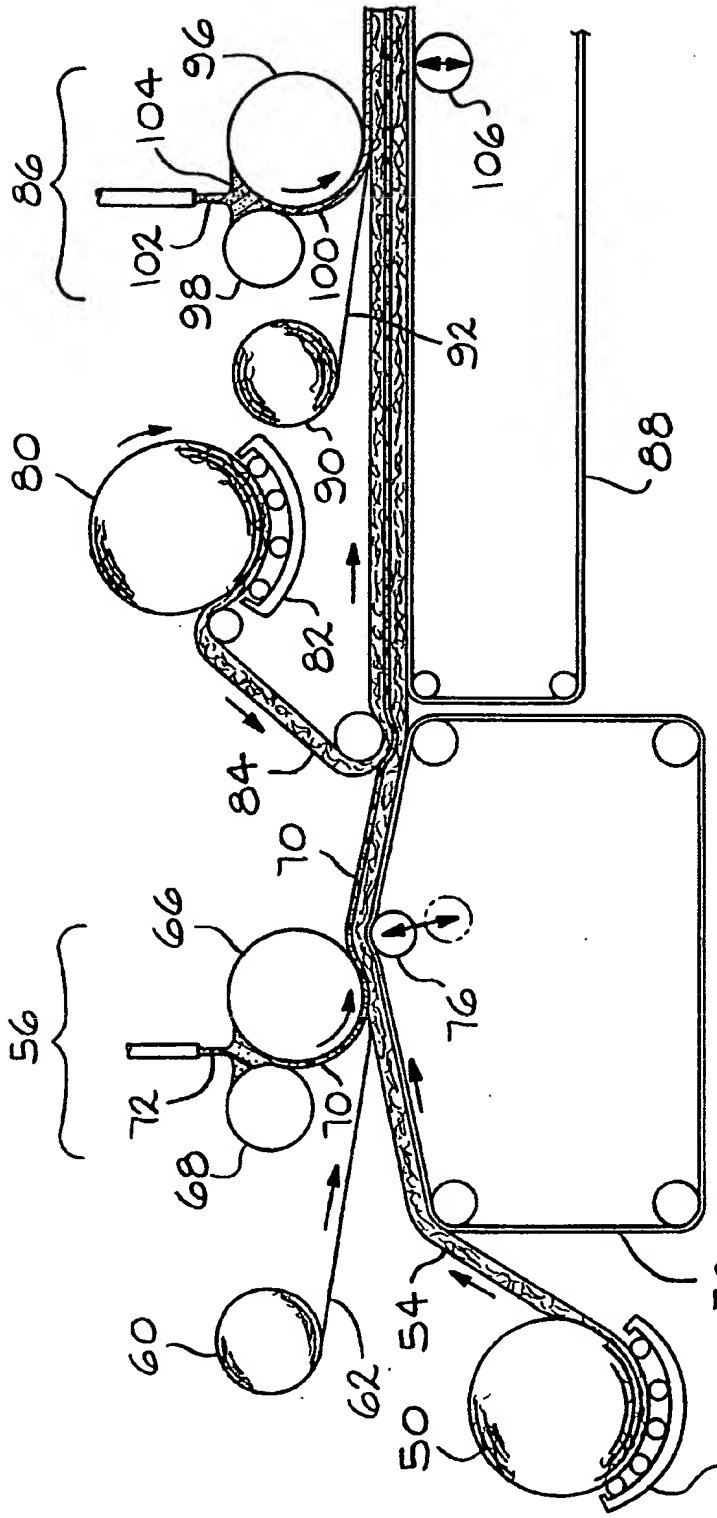


FIG. 4

Patent Agents
Smart & Biggar

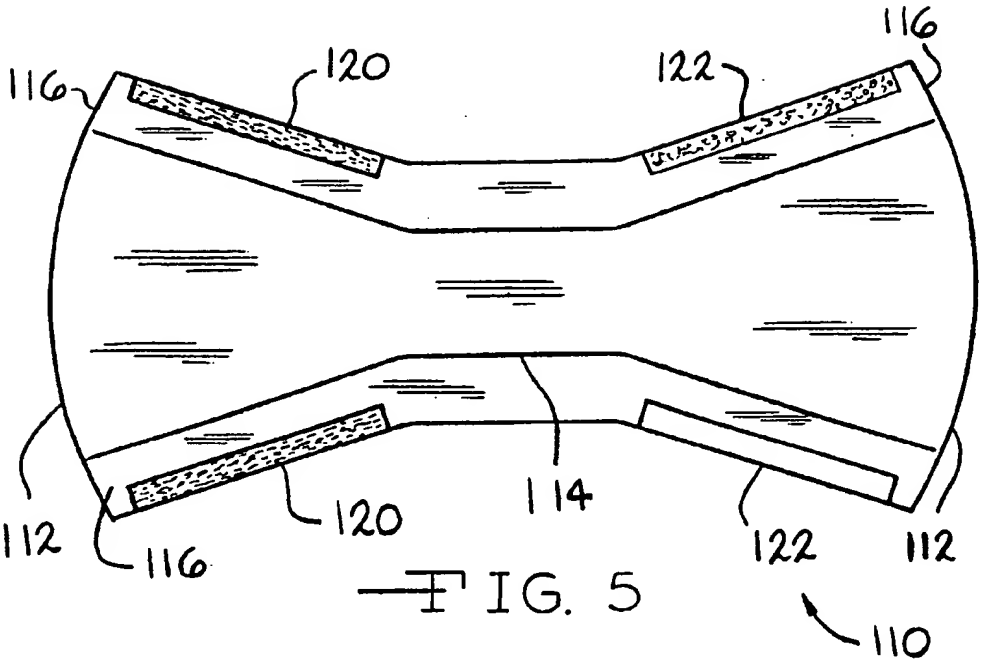


FIG. 5

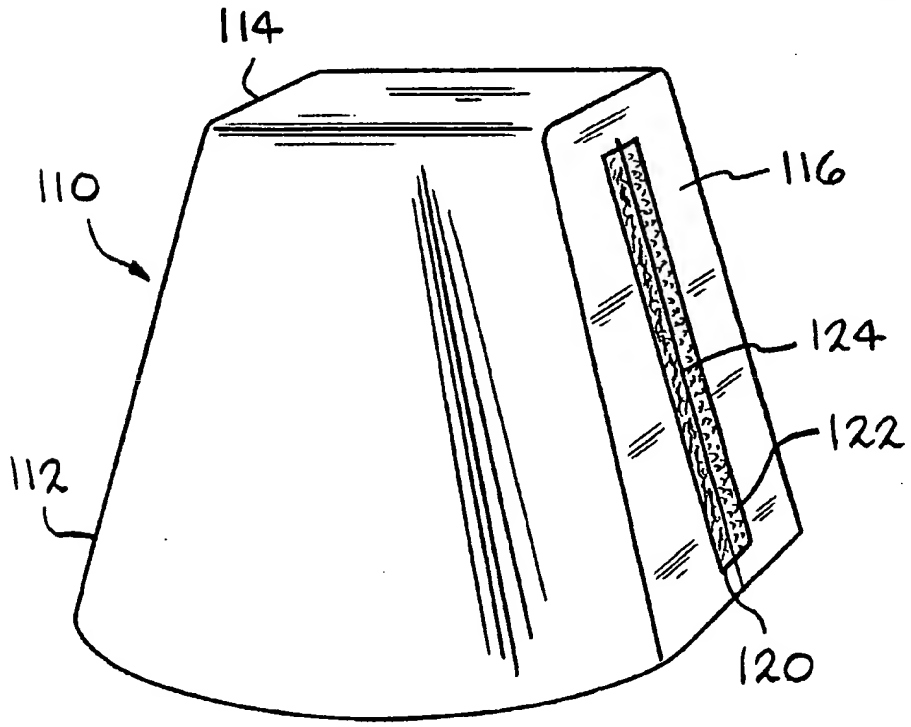


FIG. 6

Patent Agents
Smart & Biggar